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JC05 Rec'd PCT/PTO 22 MAR 2002

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. §371		Attorney Docket Number 50225-8115.US00
		U.S. Application No. (if known, see 37 CFR §1 5) 10/088922
International Application No. PCT/EP00/08584	International Filing Date March 29, 2000	Priority Date Claimed September 23, 1999

Title of Invention

METHOD FOR LINKING TWO PLASTIC WORK PIECES WITHOUT USING FOREIGN MATTER

Applicant(s) for DO/EO/US

Andreas Neyer, Matthias Jöhnck

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. §371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S C. §371.
3. ☐ This express request to begin national examination procedures (35 U.S.C. §371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. §371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. §371(c)(2)).
   - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   - b. ☒ has been transmitted by the International Bureau.
   - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. §371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
   - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   - b. ☐ have been transmitted by the International Bureau.
   - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. §371(c)(4)) (unsigned)
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U S C §371(c)(5).

Items 11. to 16. below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR §1.97 and §1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR §3.28 and §3 31 is included
13. ☐ A FIRST preliminary amendment.
    ☐ A SECOND or SUBSTITUTE preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of Power of Attorney and/or Address letter.
16. ☐ Other items or information:

10088922 .032202

JC13 Rec'd PCT/PTO 22 MAR 2002

U.S. Application No. (if known, see 37 CFR §1.5) 10/088922	International Application No. PCT/EP00/08584	Attorney's Docket No. 50225-8115.US00

17. ☒ **The following fees are submitted:**				CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 CFR §1.492(a)(1)-(5): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO .... $1,040.00 International preliminary examination fee (37 CFR §1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO .... $890.00 International preliminary examination fee (37 CFR §1.482) not paid to USPTO but international search fee (37 CFR §1.445(a)(2)) paid to USPTO .... $740.00 International preliminary examination fee paid to USPTO (37 CFR §1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4).................... $710.00 International preliminary examination fee paid to USPTO (37 CFR §1 482) and all claims satisfied provisions of PCT Article 33(1)-(4).................... $100.00					
ENTER APPROPRIATE BASIC FEE AMOUNT =				**$890.00**	-
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claim priority date (37 CFR §1.492(e)).				$	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total Claims	* - 20 =	*	× **$ 18.00**	$	
Independent Claims	* - 3 =	*	× **$ 84.00**	$	
Multiple Dependent Claim(s) (if applicable)			+ **$280.00**	**$280.00**	
TOTAL OF ABOVE CALCULATIONS =				**$1,170.00**	
☒ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by ½.				**$585.00**	
SUBTOTAL =				**$585.00**	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR §1.942(f)). +				$	
Fee for recording enclosed assignment (37 CFR §1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR §3 28, §3.31) **$40.00** per property. +				$	
TOTAL FEES ENCLOSED =				**$585.00**	
Amount To Be:				refunded	$
Amount to Be:				charged	$

a. ☐ A check in the amount of $ to cover the filing fees is enclosed.

b. ☒ Please charge Deposit Account No. 50-0665 in the amount of $ to cover the above fees. This sheet is provided in triplicate

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-0665. This sheet is provided in triplicate.

NOTE: Where an appropriate time limit under 37 CFR §1.494 or §1.495 has not been met, a petition to revive (37 CFR §1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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10/088922

JC13 Rec'd PCT/PTO 22 MAR 2002

3/PRTS

METHOD FOR BONDING TWO PLASTIC WORK PIECES WITHOUT THE USE OF FOREIGN MATTER

The invention relates to a method for the non-adhesive bonding of two contiguous plastic work pieces. The invention also relates to an article formed from at least two non-adhesively bonded work pieces, manufactured according to such method, and a preferred application of such an article.

Such methods are used, for example, in the bonding of microstructured work pieces, and they are also becoming increasingly important in the field of microfluidics for applications in reaction engineering, analytical technology, sampling technology and filtration technology, as well as in hydraulics and pneumatics. For such applications numerous miniaturized systems have been developed recently. The materials used are usually glass and silicon, and also thermoplastics. Regardless of the material used, in the fabrication of closed channels microstructures are first provided in a plane (substrate manufacturing), which in a following processing step are closed with a cover. While the process of anodic bonding is a suitable technology for glass and silicon, intensive worldwide efforts are underway to develop cost-effective methods for the bonding of microstructured plastic work pieces. Conventional bonding or adhesion methods such as the use of adhesives or heat seals, the classical method of thermo-welding, laser welding or ultrasound welding are problematic when plastics are used because of the stringent requirements for structural or dimensional stability in microtechnology. The insertion of thin-film electrodes, for example for generating an ion flow or for detecting a fluid channel which on the one hand should be easy to contact from the outside, but on the other hand should have direct contact with the medium in the closed channels, is particularly problematic because the thin-firm electrodes can become imperceptibly and unintentionally coated during the welding process.

From WO 99/51422, a method is known which is derived from classical thermo-welding, a solute thermoplastic is spun onto one or both polymer work pieces to be bonded. The solvent evaporates, and on the entire component remains a very thin film of the spun thermoplastics which has a lower melting point than the substrate or cover material. The bond is created by compression and heating to temperatures which are below the glass transition temperature of the substrate and cover material, but above that of the spun thermoplastics.

A disadvantage of the method described in the above named patent is that the solvent of the spun polymer can destroy the sensitive microstructures or nanostructures by partially or completely dissolving them. There is also the danger that corrosion cracks can occur in the microstructures. Furthermore, the microstructures or nanostructures can become plugged in the spinning process. This would make the resulting fluid structure unusable. There is also a danger that the thin-film electrodes may become coated.

Setting out from the discussed prior art, it is therefore the object of the invention to make an above named method available by which two plastic work pieces can be bonded to each other in a cost-effective manner and in a continuous manufacturing process.

This object is achieved according to the invention in that

- the intended contact surface of at least one of the two work pieces, with which it contacts the other work piece, is subjected to radiation of such a high energy level that the glass transition temperature is lowered in the marginal area,
- the two work pieces are brought into a mutual position in accordance with the intended use, and
- subsequently, to produce the bond of the two work pieces, at least the modified marginal layer in the area of its surface is heated to a temperature which is above the glass transition temperature of the marginal layer modified by radiation, but below that of the unmodified areas of the respective work piece.

With the method according to the invention, a marginal layer of the contact surface of at least one of the two work pieces, by which this work piece will be touching the other work

piece in the subsequent bond, is modified in such a way that the glass transition temperature in this marginal layer is lowered in comparison with the other parts of this work piece. This is accomplished by radiating the contact surface with a high-energy radiation, such as a UV, laser, X ray and/or synchrotron radiation. During this radiation process, the long-chain polymers are destroyed, which causes a reduction in molecular weight and thus a lowering of the glass transition temperature. The intensity and duration of the radiation depend on the plastic to be modified and on the desired strength of the marginal layer to be modified. The thickness or depth of the modified marginal layer may be only a few µm or fractions of a µm.

In a downstream processing step, the two work pieces are brought into a mutual position in accordance with the intended use. This can be done immediately following the radiation process or at any subsequent time.

Once the two work pieces are brought into a mutual position according to the intended use, the next processing step — the actual bonding step — is to heat at least the surface areas of the modified marginal layer to a temperature above the glass transition temperature of the modified marginal layer, but below the glass transition temperature of the work piece not modified in that manner. Due to the process of heating at least the surface areas of the modified marginal layer above its glass transition temperature, these softened marginal layers bond with the contact surface of the contiguous other work piece. This heating step can be accomplished either by selectively heating the modified marginal layer or appropriate parts thereof, as can be done, for example, by radiating with microwave radiation if the marginal layer is appropriately doped, or by heating the two work pieces together in the mutual position according to the intended use.

The main advantage of this method is that the bond between the two work pieces is accomplished without the use of extraneous materials, in particular without adhesives or solvents. Furthermore, the thickness of the modified marginal layer can be adjusted so that it is considerably smaller than the depth of a microstructure or nanostructure, thus avoiding the danger of a material flowing into and plugging such a structure during the bonding process. Furthermore, the two work pieces brought into a mutual position according to the intended use can be held under pressure in relation to each other during the process of heating the

modified marginal layer, since the unmodified areas and those containing the structures are not softened and thus remain dimensionally stable. Furthermore, this method is suitable for the production of continuously manufactured articles consisting of two components, for example, for bonding two films, since the process of radiation and mutual alignment as well as the process of heating can be continuous when films are used.

The microstructure or nanostructure can be inserted into one of the two work pieces in an upstream processing step.

The method can also be used in such a way that the contact surfaces of both work pieces are subjected to the radiation process to develop such a modified marginal zone with a lowered glass transition temperature in both, so that both modified marginal layers are softened during the heating step and fuse together.

The method according to the invention is also particularly suitable for bonding two contiguous plastic work pieces when the contact surface of one work piece carries an electrode such as a structured thin-film electrode. By limiting the amount of material involved in the bonding process, which can be reduced to a minimum, this method — in contrast to the prior art — also prevents the electrodes from becoming covered by volatile constituents or molten material. Furthermore, when both work pieces be subjected to the radiation process, there is the advantage that the underground under the electrodes is not modified and thus remains dimensionally stable. This means that the electrode is not subjected to much mechanical stress during the bonding process and is therefore not damaged or destroyed by cracking, as may be the case with other thermal bonding processes when the softened underground yields under stress.

Below, the object of the invention is described by means of an embodiment and with reference to the drawings, where

Fig. 1 shows a schematic three-dimensional view of a microfluid element consisting of two work pieces;

Fig. 2 shows one of the work pieces from Fig. 1, provided with microstructural recesses, in a first processing step;

Fig. 3 shows the work piece from Fig. 2 after completion of the first processing step, with a modified marginal layer;

Fig. 4 shows the two work pieces from Fig. 1 brought into a mutual position in accordance with the intended use;

Fig. 5 shows the bonded work pieces from Fig. 4, and

Fig. 6 shows a schematic cross section of another microfluid element with integrated thin-film electrodes.

A microfluidic element 1, a partial view of which is shown in Fig. 1, consists of two work pieces 2, 3, which, when bonded together, form the microfluid element 1. Work pieces 2 and 3 are films made from a thermoplastic such as polymethylmethacrylate (PMMA). However, the thermoplastics may certainly also consist of polycarbonate or a polymethacryl, In general, any plastic can be used whose surface, when subjected to high-energy radiation, can be modified so that the glass transition temperature of the modified layer lies below that of the starting material. The top surface of work piece 2 has channel-like recesses V, resulting in a structured surface of work piece 2. The webs S which separate the recesses from each other and whose top surfaces are all arranged in the same plane, together form individual contact surfaces K, on which, bordering on the finished microfluid element 1, borders the underside U of work piece 3, which serves as the contact surface. Thus, work piece 3 serves as a cover for closing the recesses V of work piece 2, enabling them to form channels.

To connect the two work pieces 2, 3, it is provided in a first step that the contact surfaces of the two work pieces 2, 3 (as shown in Fig. 2 only by means of work piece 2) are radiated by a high-energy radiation — indicated by the arrows — to achieve a lowering of the glass transition temperature in the marginal layer that borders on the top surface.

In the embodiment described here, the PMMA surface is preferably modified by UV radiation in the wavelength range of 250-280 nm. Practically any mercury vapour lamp whose tube is transparent in the appropriate wavelength range can be used for this purpose. The necessary radiation periods depend on the lamp intensity. The connection between intensity and depth of damage during the radiation of PMMA with a respective UV source is explained in detail in Frank et al (W.F.X. Frank, B. Knödler, A. Schösser, T.K. Strempel, T Tschudi, F. Linde, D. Muschert, A. Stelmszyk, H. Strack, A. Bräuer, P. Dannberg, R. Göring, "Waveguides in Polymers"; Proceedings SPIE vol. 2290, pages 125-132.

In the example of PMMA, the lowering of the glass transition temperature is approximately 35° C, which means that in the embodiment described, the glass transition temperature was also lowered from 105° C to 70° C.

The UV radiation of PMMA as a work piece material has been studied in detail by A. Schösser, B. Knödler, T. Tschudi, W.F.X. Frank, A. Stelmaszyk, D. Muschert, D. Rück, S. Brunner, F. Pozzi, S. Morasca. C. de Bernardi, "Optical components in polymers", SPIE, vol 2540, pages 110-117; and radiation with X rays in LIGA-Verfahren [LIGA Method], W. Menz, J. Mohr, "Mikrosystemtechnik für Ingenieure" [Microsystems Technology for Engineers], VCH-Verlag, Weinheim, 1997. These indicate that such radiation causes substantially a reduction in the molecular weight of PMMA.

The marginal layer R of work piece 2, modified by the radiation process, is shown in Fig. 3; the modified marginal layer of work piece 3 is designed accordingly. The drawing explains not only that the contact surfaces K have a modified marginal layer R on the top surface, but also that the lowest point of recesses V has a corresponding marginal layer. However, the latter is of no consequence for the method of bonding the last work pieces 2, 3 with each other. It also does not affect the usability of the subsequently formed channel. Instead of radiating the entire surface of work piece 2, as shown in Fig. 2, radiation can also be selective, for example by introducing a mask, if only the marginal layers of certain sections, such as contact surfaces K, are to be modified as described.

In a next step, to bond the two work pieces 2, 3 together, work piece 3, which serves as a cover, is placed by its modified marginal layer R onto the contact surfaces K of work

piece 2, so that the recesses V are closed and are now representing fluid channels. In this situation, it is practical to fix the two work pieces 2, 3 to each other, as indicated schematically by the two arrows pointing in opposite direction.

Finally, to produce a chemical bond between the two work pieces 2, 3, these are heated to a temperature that is above the glass transition temperature of the modified marginal layers R, R', but below that of the unmodified areas of work pieces 2, 3. In the embodiment shown, work pieces 2, 3 are heated to a temperature of about 90° C. After the modified marginal layers R, R' have exceeded their glass transition temperature (70° C), they soften so that the two modified marginal layers R, R' fuse with each other. If, as also shown in Fig. 4 and 5, the two work pieces 2, 3 exert pressure upon each other, this benefits the bonding process. After cooling down to below the glass transition temperature, work pieces 2, 3 are bonded. The former contact surface between the two work pieces 2, 3 is shaded in Fig. 5.

It should be emphasized that during this heating process, the glass transition temperature of the unmodified work piece sections is not exceeded. They retain their dimensional stability, and there is no danger that the recesses V are pinched or plugged during the bonding process.

In the design of microstructured components, it is practical when the two work pieces 2, 3 are made of the same material — as provided in the embodiment shown —, since the lateral walls of the channels that are formed have the same surface characteristics around the circumference, due to the homogeneous material. Thanks to the non-adhesive bond of the two work pieces 2, 3 and to the fact that they are made of identical material, the bond surface does not represent a potential weak point, as could happen, for example, in case of thermal stress, if different materials with different expansion coefficients are used.

Fig. 6 shows another microfluid element 4 formed by bonding two work pieces 5, 6, also both made of PMMA film. Work piece 5 is identical to work piece 2 of the previous embodiment. Work piece 6 is the cover for closing recesses V; in contrast to cover 3, it has electrodes E on the underside. The electrodes E extend to some recesses V o that measurements can be taken in the channels formed by recesses V in microfluid element 4, for

[redacted]

example, to measure the conductivity of the fluid carried in such a channel. The two work pieces 5, 6 are bonded in the same manner as described in Fig. 2 to 5, to form microfluid element 4. The description of the bonding method explains that it eliminates the danger of the surfaces of electrodes E, which form a lateral wall in some regions, being damaged or coated.

The bonding method according to the invention can be regarded as a hot-melt adhesion method, in which — as a result of a radiation-induced reduction in molecular weight — the hot-melt adhesion is produced by a marginal layer of the base material of the work pieces to be bonded.

WHAT IS CLAIMED IS:

1. Method for non-adhesive bonding of two contiguous plastic work pieces (2, 3; 5, 6),

characterized in that

— the intended contact surface (K) of at least one of the two work pieces (2, 5 or 3, 6) by which it borders on the other work piece (3, 6 or 2, 5) is at least in some sections subjected to a high-energy radiation which causes the lowering of the glass transition temperature in a marginal layer (R, R'),

— the two work pieces (2, 3; 5, 6) are brought into a mutual position according to the intended use, and

— subsequently, to produce the bond of the two work pieces (2, 3; 5, 6) at least the modified marginal layer (R, R') in the area of its surface is heated to a temperature which is above the glass transition temperature of the marginal layer (R, R') modified by radiation, but below that of the unmodified areas of the respective work piece (2, 3; 5, 6).

2. Method according to Claim 1, **characterized in that** the entire contact surface (K) is subjected to the high-energy radiation process.

3. Method according to Claim 1 or 2, **characterized in that** the step of heating is performed while the two work pieces (2, 3; 5, 6) are under pressure in relation to each other.

4. Method according to one of Claims 1 to 3, **characterized in that** the two work pieces (2, 3; 5, 6) brought into a mutual position according to their intended use are heated to accomplish the bond.

5. Method according to one of Claims 1 to 4, **characterized in that** the contact surfaces of the two work pieces (2, 3) are radiated with high-energy radiation for the formation of a modified marginal layer (R, R') on each.

6. Article (1, 4) formed of two work pieces (2, 3; 5, 6) non-adhesively bonded together, produced according to one of the above Claims, **characterized in that** in at least one contact surface (K) of the two work pieces (2, 5), recesses (V), in particular channel-like recesses, are provided.

7. Article according to Claim 6, **characterized in that** the recesses (V) are formed as microstructures and/or nanostructures.

8. Article according to Claim 6 or 7, **characterized in that** at least one of the two work pieces (6) is provided with electrodes (E), in particular with structured thin-film electrodes, on its contact surface.

9. Article according to Claim 8, **characterized in that** the electrodes (E) on the contact surface and the channel-like recesses (V) are assigned to the other work piece (5), and that the electrodes in at least some sections form a wall of a closed recess (V) after the two work pieces (5, 6) are bonded.

10. Article according to one of Claims 6 to 8, **characterized in that** at least one of the two work pieces is designed as a microstructured and/or nanostructured filter.

11. Application of an article according to one of Claims 6 to 10, **characterized in that** at this article is used as a microanalysis unit or a microreactor unit.

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(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

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Internationales Büro

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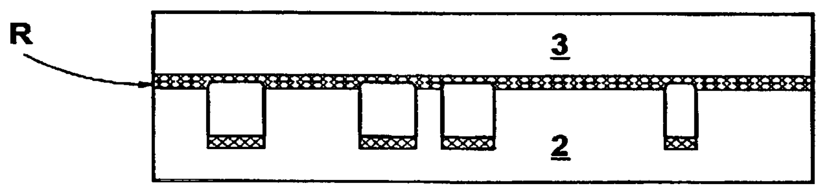
(81) **Bestimmungsstaaten** *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT,

[Fortsetzung auf der nächsten Seite]

(54) **Title:** METHOD FOR LINKING TWO PLASTIC WORK PIECES WITHOUT USING FOREIGN MATTER

(54) **Bezeichnung:** VERFAHREN ZUM FREMDSTOFFFREIEN VERBINDEN VON ZWEI WERKSTÜCKEN AUS KUNSTSTOFF



(57) **Abstract:** The invention relates to a method for linking two adjacent plastic work pieces (2, 3). The inventive method is characterized in that the intended contact zone (K) of at least one of the two work pieces (2) with which the latter adjoins to the other work piece (3) is at least partially subjected to a high-energy radiation to such an extent that the glass transition temperature is reduced in a marginal zone (R). The two work pieces (2, 3) are brought in the desired position relative to each other. For establishing the connection of the two work pieces (2, 3) at least the marginal zone (R) modified by the previous radiation process is heated at least in its surface area to a temperature that is higher than the glass transition temperature of the marginal zone (R) modified by the radiation process but lower than the glass transition temperature of the zones of the work pieces (2, 3) that have not been modified. The invention also relates to an article (1) produced according to the inventive method that consists of two work pieces (2, 3) that are linked without using foreign matte. The inventive article is characterized in that recesses (V), especially channel-shaped recesses, are introduced in at least one contact zone (K) of the two work pieces (2).

(57) **Zusammenfassung:** Ein Verfahren zum fremdstofffreien Verbinden von zwei aneinander grenzenden Werkstücken (2, 3) aus Kunststoff ist dadurch bestimmt, daß die vorgesehene Kontaktfläche (K) zumindest eines der beiden Werkstücke (2), mit der dieses in der Verbindung an das andere Werkstück (3) grenzt, wenigstens bereichsweise einer solchen energiereichen Strahlung ausgesetzt wird, daß die Glasübergangstemperatur in einer Randschicht (R) abgesenkt wird, die beiden Werkstücke (2, 3) in ihre bestimmungsgemäß e Position zueinander gebracht werden und anschließ end zum Herstellen der Verbindung der beiden Werkstücke (2, 3) zumindest die durch den Bestrahlungsvorgang jeweils modifizierte Randschicht (R) wenigstens im Bereich ihrer Oberfläche auf eine Temperatur erwärmt wird, die oberhalb der Glasübergangstemperatur der durch die Bestrahlung modifizierten Randschicht (R), jedoch unterhalb der Glasübergangstemperatur der diesbezüglich unmodifizierten Bereiche des jeweiligen Werkstückes (2, 3) liegt. Ein aus zumindest zwei, miteinander fremdstofffrei verbundenen Werkstücken (2, 3) gebildeter Gegenstand (1) hergestellt nach dem Verfahren ist dadurch bestimmt, ß in zumindest in eine Kontaktfläche (K) der beiden Werkstücke (2) Vertiefungen (V), insbesondere kanalartige eingebracht sind.

WO 01/21384 A1

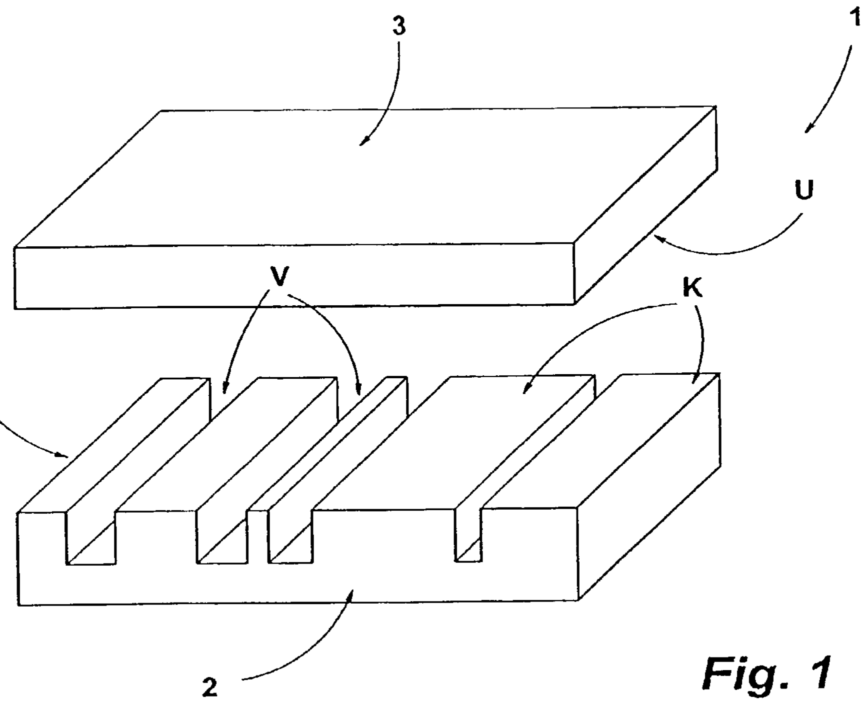


Fig. 1

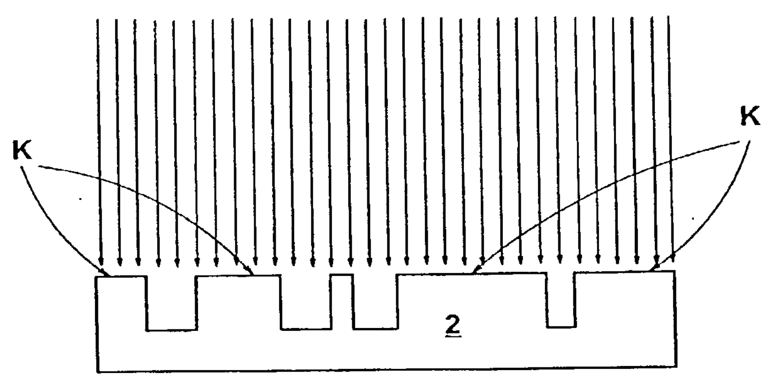


Fig. 2

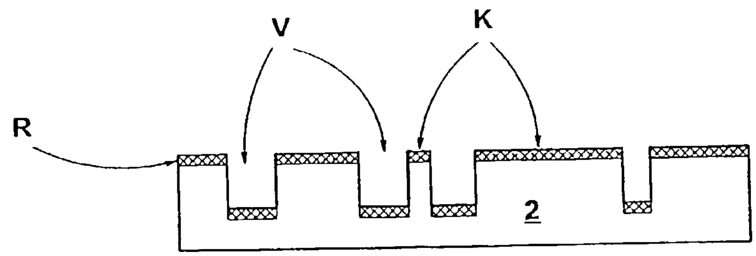


Fig. 3

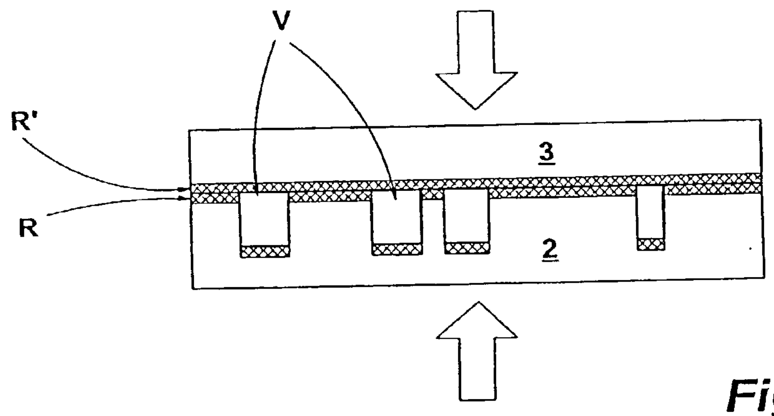


Fig. 4

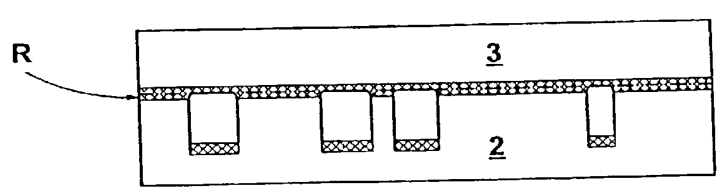


Fig. 5

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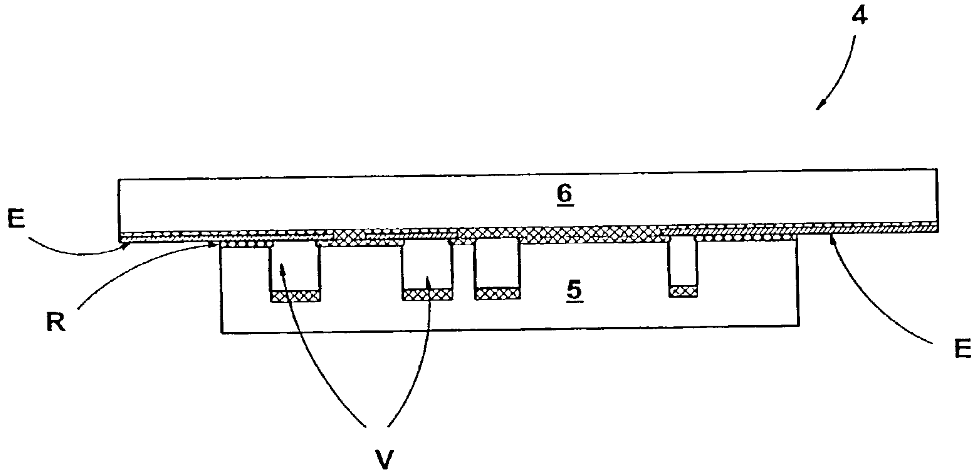

Fig. 6

Attorney Docket No.: 50225-8115.US00

INVENTORSHIP DECLARATION BY JOINT INVENTORS

I HEREBY DECLARE THAT:

My residence, mailing address, and citizenship are stated next to my name in PART A hereof.

I believe I am the original, first, and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled

METHOD FOR LINKING TWO PLASTIC WORK PIECES WITHOUT USING FOREIGN MATTER

the specification of which:

☐ is attached hereto.

☒ was filed on March 22, 2002 as Application Serial No. 10/088,922.

I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with 37 CFR §1.56, including, for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim priority benefits under 35 USC §119(a)-(d) or (f), §172, or §365(a)-(b) of any foreign or international application(s) for patent or inventor's certificate listed in PART B hereof and have also identified in PART B hereof any such foreign or international application having a filing date before that of the application of which priority is claimed.

I hereby declare that all statements made herein of my knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon. I understand that the execution of this document does not in itself establish an attorney-client relationship between the undersigned and Perkins Coie, LLP, or any of its attorneys.

See page 2 attached, signed, and made a part hereof.

Attorney Docket No 50225-8115 US00

I hereby certify that this correspondence is being deposited with the U.S. Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C., 20231, on:

Date: 8-13-02 By: [signature]

OIPE JCISS AUG 2 2 2002 PATENT & TRADEMARK OFFICE

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF:

Andreas NEYER *et al.*

APPLICATION NO.: 10/088,922

FILED: March 22, 2002

FOR: METHOD FOR LINKING TWO PLASTIC WORK PIECES WITHOUT USING FOREIGN MATTER

EXAMINER: NOT ASSIGNED

ART UNIT: NOT ASSIGNED

CONFIRMATION NO.: 2657

Power of Attorney by Inventors

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

I hereby appoint the following agent(s) and attorney(s) to prosecute and transact all business in the Patent and Trademark Office connected herewith:

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INVENTOR INFORMATION AND SIGNATURE

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Inventor's Signature: Andreas Neyer Date: 18.07.2002

Full name of SECOND inventor: Matthias Jöhnck

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Inventor's Signature: Matthias Jöhnck Date: 18.07.2002

Attorney Docket No.: 50225-8115.US00

INVENTORSHIP DECLARATION BY JOINT INVENTORS

PART A: INVENTOR INFORMATION AND SIGNATURE

1-00

Full name of FIRST inventor: Andreas Neyer

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2-00

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Inventor's Signature: Matthias Jöhnck   Date: 16. 07. 2002

[redacted]

INVENTORSHIP DECLARATION BY JOINT INVENTORS

PART B: CLAIM TO PRIORITY OF FOREIGN APPLICATION(S) UNDER 35 U.S.C. 119(a-d) and (f) §172, or §365(a)-(b)

Country	App. No.	Filing Date	Priority Not Claimed
Germany	DE 199 45 604.6	09/23/99	☐
Australia	AU 200077744	04/21/01	☐
WIPO	PCT/EP00/08584	09/02/00	☒